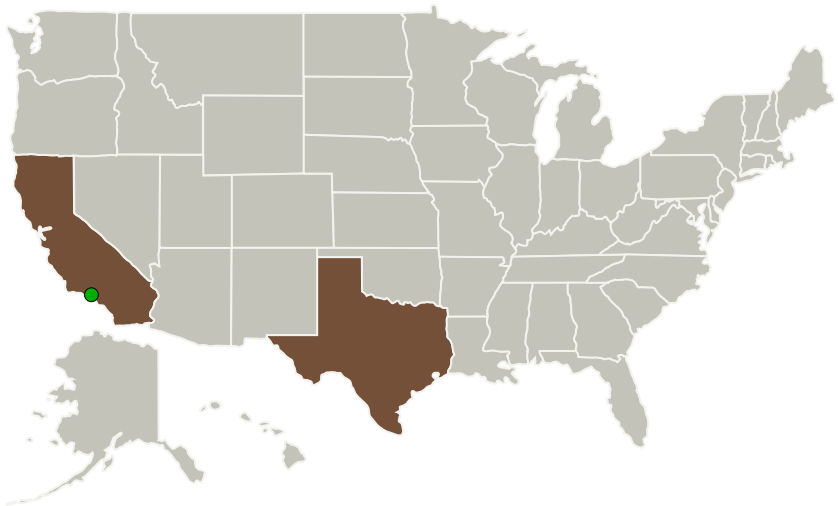
High-Speed Radiation Tolerant Avalanche Photodiodes Based on InGaN for Space Altimeter Systems, Phase I

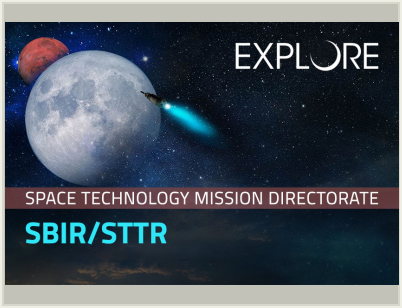
Completed Technology Project (2012 - 2012)

Project Introduction

High-performance, radiation-tolerant detectors are required for the time-of-flight laser based rangefinders. Avalanche photodiodes (APDs) are conventionally chosen as detectors for standard laser rangefinder systems. However, the performance of currently used APDs degrades significantly after exposure to high levels of radiation. Integrated Micro Sensors Inc (IMS, Houston, TX)) proposes novel intrinsically radiation-tolerant III nitrides based high-speed APDs superior for use in space-based laser-altimeter systems. The Indium Gallium Nitride (InGaN) alloy has the potential of forming photovoltaic devices covering a range of 0.7 eV (InN) to 3.4 eV (GaN). This energy range allows for providing a perfect match to the 1.06 um wavelength (~1.17 eV) of the lasers used in the time-of-flight range finders. The III-Nitrides exhibit inherent chemical and thermal ruggedness, which makes them suitable for several space and military applications. It has recently been determined that these Nitride materials can offer exceptional radiation tolerance that is well beyond what can be achieved with conventional materials that are currently flown into space. The InGaN APDs to be developed in this project will be targeted for operating conditions up to 250 oC, and up to 2 MeV proton irradiation, which are substantially higher than those for the standard currently used materials, such as Si or GaAs. IMS envisions that devices developed in this project would be especially beneficial to Europa Jupiter System Mission (EJSM) that requires high performance sensors and detectors that can operate with low noise under the severe radiation environment.The ultimate goal of this project is to develop high-speed, radiation-tolerant visible-blind APDs responding to laser beams of 1.06 um wavelength for rangefinder applications.

Primary U.S. Work Locations and Key Partners





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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Integrated Micro Sensors, Inc.	Lead Organization	Industry	Houston, Texas
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Texas

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138587)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Integrated Micro Sensors, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

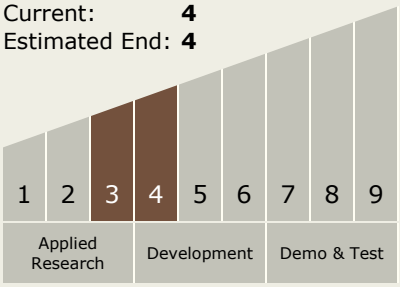
Carlos Torrez

Principal Investigator:

David Starikov

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2012 - 2012)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System